

**MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION  
MANUAL (MARSSIM) WORKGROUP MEETING NOTES**

MONDAY, JUNE 13, 2005

**ATTENDEES:**

U.S. Environmental Protection Agency - USPHS: Captain C. Petullo  
U.S. Environmental Protection Agency - Region II: N. Azzam  
U.S. Environmental Protection Agency - Region II: P. Giardina  
U.S. Nuclear Regulatory Commission - RES: R. Meck  
U.S. Nuclear Regulatory Commission - RES: G. Powers  
U.S. Air Force: R. Bhat (by phone)  
U.S. Air Force: Major C. Bias  
U.S. Navy: S. Doremus  
U.S. Army: D. Chambers  
U.S. Department of Homeland Security: C. Gogolak

**MEMBERS OF THE PUBLIC:**

Cabrera Services, Inc.: S. Hay (U.S. Air Force contractor)  
Cabrera Services, Inc.: N. Berliner (U.S. Air Force contractor)

**ADMINISTRATIVE ISSUES**

C. Petullo and P. Giardina welcome the MARSSIM Workgroup to the EPA Region II offices in New York. C. Petullo notes that the WG objectives are ambitious for the October 1 internal agency review (IAR) goal, and that Chapters 4 and 6 are especially important for this meeting.

**AGENCY UPDATES**

C. Gogolak describes DHS funding issues that will reduce his involvement in the MARSSIM WG to extremely limited after October 1<sup>st</sup>, and that EML's involvement in the MARSSIM WG may end with this calendar year. DHS' involvement may continue if the ISCORS representative from DHS expresses interest in continuing his agency's participation and can help obtain funding. C. Gogolak closes by noting that he has been granted travel funding to continue with the MARSSIM WG to the end of 2005.

**ACTION ITEM:** C. Gogolak to check as to whether another DHS representative would be assigned to the MARSSIM WG after his scheduled departure by January 1, 2006.

R. Meck indicates that the NRC has disapproved the proposed rule for Radiological Criteria for Controlling the Disposition of Solid Materials (SECY-05-0054) as of June 1, 2005, and the decision regarding solid materials has been deferred indefinitely. He

continues that the immediate need for this ruling changed due to the timing of decommissioning operations and other higher priority items. A letter from Congressman Edward Markey expressed concerns related to the rule, specifically pertaining to the potential release of materials that should be under radiological control. R. Meck also notes that the proposed rule has encompassed work over a period of 28 years and \$10 million. R. Meck continues that since MARSAME is not a ruling, the NRC could also be planning to cut participation in MARSAME as it too may be seen as unnecessary. Therefore, R. Meck states that he would like to push for publication of MARSAME as soon as possible and get on the schedule for the SAB review. C. Petullo indicates that the current schedule for MARSAME involves SAB review in the spring of 2006. R. Meck asks if MARSAME could be placed on the schedule for the fall 2005 meeting instead, making SAB review concurrent with IAR (as opposed to being concurrent with public review). C. Petullo responds that other agencies will have a problem with this approach.

**ACTION ITEM:** C. Petullo to get MARSAME scheduled for SAB review either for fall 2005 or spring 2006.

R. Meck moves on to the topic of a 221-page draft document released by IAEA in May 2005 that parallels MARSAME. The document is entitled *Monitoring Compliance with Exclusion, Exemption and Clearance Values*. The IAEA elicits comments on their documents from hand-selected parties.

The author of Spanish MARSAME emailed R. Meck in April 2005 asking how MARSAME will deal with combining surficial and volumetric criteria for disposition and how to deal with and apply scaling factors (e.g., maximum,  $\bar{x} + 2\sigma$ , 95% confidence).

**ACTION ITEM:** R. Meck to distribute electronic copy of Spanish MARSAME to the WG.

**ACTION ITEM:** C. Petullo to furnish electronic copy of IAEA document to the WG. The document may be posted on a secure EPA site for review.

R. Meck notes that he has 8,000 data points pertaining to areas that have been cleaned up to DOE Order 5400.5 criteria. G. Powers has utilized a software program to fit this data to distribution curves for demonstrating errors qualified through different statistical analyses, and recommending assumptions for evaluating the data. This will be presented to the WG.

D. Chambers proceeds with the Army update. He notes that BRAC implementation scheduled for late 2006 will benefit from MARSAME and help to standardize BRAC procedures (all Army bases have radiation commodities). He outlines the following questions that MARSAME will hopefully help to resolve:

- Where is the division between surficially- and volumetrically-impacted material?
- Where is the division between consolidated and unconsolidated material?

75 He continues that it is difficult to know how to treat both divisions. He states that  
76 geologists define unconsolidated as 10 inches in any dimension. He adds that the Army  
77 has the same questions raised by the author of Spanish MARSAME (i.e., how  
78 MARSAME will deal with combining surficial and volumetric criteria for disposition and  
79 how to deal with and apply scaling factors), as it is difficult to know how to treat both.  
80 As an example, he states that soil may constitute unconsolidated material, and that a brick  
81 wall may constitute consolidated material.

82 R. Bhat states that the Air Force has about 180 weapons tanks used as targets for depleted  
83 uranium rounds to be disposed of, with approximately 20 to 25 of them destined for a  
84 waste site. He adds that a contractor has performed clearance surveys on eight of the  
85 tanks, but they are still working on calculating the total propagated uncertainties for the  
86 surveys.

87 C. Bias announces that R. Bhat will have a new supervisor (Lt. Col. Mark Wrobel) as  
88 head of health physics for the Air Force in a couple of weeks. He adds that Lt. Col. M.  
89 Wrobel should keep MARSAME funding intact. R. Bhat's office and branch, C. Bias'  
90 office and branch, and C. Bias' advisor are all advocating C. Bias' continued  
91 participation in the MARSSIM WG. C. Bias continues that he will not be available to  
92 attend the July WG meeting, but will be available to review and furnish comments for  
93 deliverables prepared for the meeting. He adds that he is unsure about his availability in  
94 either respect for the August meeting.

95 **ACTION ITEM:** R. Bhat to confirm the future of Air Force participation (i.e., C. Bias  
96 or another representative) in the MARSSIM WG with Lt. Col. M. Wrobel.

97 BRAC has published a new list of facilities to be closed and missions realigned (moved),  
98 including three Air Force bases (Brooks AFB, Texas; Cannon AFB, New Mexico; and  
99 Ellsworth AFB, South Dakota). The closure of Brooks AFB in 2009 would realign  
100 AFIOH to Dayton, Ohio. The BRAC committee will continue to conduct on-going visits  
101 and evaluations of facilities, and submit more recommendations for closure in September  
102 2005. The President may choose to accept or reject BRAC's recommendations; this is an  
103 iterative process scheduled to be completed by November 29, 2005.

104 S. Doremus begins the Navy agency update by stating that the U.S. Navy has unwavering  
105 support for MARSAME and the MARSSIM WG. Naval Submarine Base Groton,  
106 Connecticut and Portsmouth Naval Shipyard, Kittery, Maine are currently on the BRAC  
107 closure list. He describes three projects at Hunter's Point, one of which has plans for  
108 utilizing a conveyORIZED survey monitoring (CSM) system to assist with releasing a soil  
109 pile. The CSM system will operate with a belt speed of one foot per second to screen  
110 assorted materials for radium dials and gauges, <sup>137</sup>Cs, and other radiological contaminants  
111 of concern. He adds that the system is not sensitive enough to detect radioactivity at  
112 background concentrations, that it is only good for elevated areas of activity (e.g., spikes  
113 of <sup>226</sup>Ra).

114 C. Petullo discusses the wildfire emergency response at the Nevada Test Site "buggy  
115 site", at which the fire spread towards an area with large amounts of residual plutonium.

116 Emergency response personnel donned self-contained breathing apparatuses (SCBAs),  
117 and then the planning team looked at conducting clearance survey for all the fire fighting  
118 equipment used in the effort. She does not foresee any issues with continuing EPA and  
119 Superfund support for the MARSSIM WG, though the future is still unknown. She states  
120 that the goal for MARSAME publication remains October 1, 2006. R. Meck and D.  
121 Chambers opine that the next document in the series, MARSAS, should not present  
122 challenges when it comes to obtaining funds, as it pertains to such a problematic media  
123 (i.e., subsurface). For MARSAS, the document may need to have an expanded scope to  
124 include all contaminants, and may follow a different process.

## 125 ADMINISTRATIVE ISSUES

126 C. Petullo recaps upcoming meeting dates:

- 127 • July 25 to 29
- 128 • August 22 to 26
- 129 • September 26 to 30 (IAR Approval)

130 C. Petullo states that she will not be available on July 28. C. Gogolak notes that he may  
131 have to call into the August 22 to 26 meeting, and that he will have to call in for the  
132 September 26 to 30 meeting.

## 133 DATA DISTRIBUTION DISCUSSION

134 R. Meck and G. Powers present the field data (the 8,000 data points described earlier by  
135 R. Meck) collected from surface soil and roof-top scanning using a Ludlum 2221  
136 scaler/rate-meter/single-channel analyzer and an undisclosed detector (quite possibly a  
137 gas-flow proportional). The data was collected while surveying multiple materials,  
138 corrected for background, and multi-modal distribution curves were generated. No  
139 generic approach seems to have been used, and the data does help demonstrate the  
140 importance of segregation.

## 141 CHAPTER 4

142 The WG begins discussion of Chapter 4. C. Petullo notes that discussion of Chapter 6  
143 will jump back into Chapter 4. NOTE: Many specific editorial comments noted at the  
144 meeting are not discussed in the minutes.

145 D. Chambers questions the overall level of readership in Chapter 4, and asks if the level  
146 of depth is appropriate. He states that the audience needs to be clearly identified, and it  
147 must be specific throughout the entire MARSAME document. He continues that  
148 MARSSIM guidance is not used by technicians, that it is very complicated and takes time  
149 to understand. S. Doremus adds that it takes approximately 1.5 years to train a new  
150 employee in the proper understanding and use of MARSSIM.

151 R. Meck makes a comment about having to hold two or three thoughts in his head in the  
152 course of a single sentence, and notes that the need for this will make the guidance more

153 difficult to understand and use. The addition of more sentence breaks can help remedy  
154 this problem. D. Chambers agrees that if it is difficult for someone at his level to track  
155 the meaning of a sentence then it must be very difficult for the “technician in the trailer”  
156 trying to use the guidance.

157 C. Bias notes that he likes the introduction and conclusion, clearly stating what the  
158 “inputs and outputs” of the chapter are.

159 C. Bias questions the paragraph from lines 31 to 39, stating that ideal data will never be  
160 available from field measurements. He continues that the ideal decision rule can  
161 therefore be eliminated, and only the operational retained. C. Gogolak contends that EPA  
162 QA/G-4 uses the ideal/operational format and that MARSAME should conform to this  
163 format as well.

164 R. Bhat comments on the sentence starting on line 49 “They [i.e., the null hypothesis and  
165 the alternative hypothesis] are mutually exclusive and together describe all possible  
166 levels of radioactivity under consideration,” asking that mutually exclusive events be  
167 described with respect to the statistical concept. C. Gogolak explains that the margins of  
168 the grey region pertain to each hypothesis.

169 **ACTION ITEM:** S. Hay to check for discrimination limit versus discrimination level.  
170 According to MARLAP, the correct term should be discrimination limit.

171 S. Doremus notes that on line 86, process knowledge can be used to narrow the width of  
172 the grey region.

173 C. Gogolak cites having problems with setting the Scenario B action level to the  
174 instrument MDC (lines 105 to 107). R. Meck reiterates (from Chapter 4) that “when the  
175 action level is not zero, the discrimination level is determined through negotiations with  
176 the stakeholders”. C. Gogolak then asks what goes into the decision of how hard to look.  
177 R. Meck replies that “How Hard to Look” is a document based on Regulatory Guide  
178 1.86. S. Hay asks if this document can be used as an example in MARSAME. R. Meck  
179 responds “yes.” C. Gogolak mentions a short email sent to G. Powers a while back  
180 which would also be useful for S. Hay. He also notes that Chapter 4 might be based on  
181 the pre-2000 version of EPA QA/G-4, and that using a newer version might be better.

182 **ACTION ITEM:** R. Meck to find Health Physics Positions (HPPOS) NUREG  
183 document *Guide on “How Hard You Have to Look” as Part of Radioactive*  
184 *Contamination Control Program* (HPPOS-072 PDR-9111210170), and email to S. Hay.

185 C. Bias requests that the concept of direct activation be added to lines 219 to 220.

186 S. Hay asks the WG to focus on line 222 and the exception to performing Class 1 surveys  
187 on M&E that has been decontaminated using a judgmental, graded approach. C. Gogolak  
188 asks if it is even worth debating, as either you can survey or you cannot, since the class  
189 distinctions are not as crucial in MARSAME as they are in MARSSIM. The WG decides  
190 to skip the text pertaining to this exception, but to allow R. Meck and K. Snead to revisit

191 the issue when both are present. This issue is addressed starting on line 866 of this  
 192 document on Friday, June 17, 2005.

193 C. Petullo, D. Chambers, and S. Hay visit the distinctions between the terms activity  
 194 versus radioactivity, and radioactivity level versus surficial or volumetric activity. No  
 195 one can find technical basis for stating that any terms discussed are more “correct” than  
 196 any other. No unilateral consensus is formed for which terms to apply in MARSAME.

197 C. Gogolak comments on the definition of Class 3 M&E in Section 4.3.3, stating that this  
 198 definition presents incongruous information as the M&E can be defined as either  
 199 impacted or non-impacted and must be revisited.

200 C. Gogolak asks for the statement starting on line 260 describing the distinction between  
 201 activity concentration and activity level as a basis for comparison to action levels to be  
 202 explained more clearly.

203 S. Doremus notes surrogate measurements as mentioned on line 329. D. Chambers  
 204 revisits surrogate measurements as described in Chapter 3. S. Hay and N. Berliner  
 205 discuss the use of surrogate measurements with the WG, and site their usage in case  
 206 studies 1 and 3. The WG agrees with the contractors’ usage of surrogate measurements  
 207 and moves on.

208 S. Doremus raises issue with the statement that “Radioactivity is not randomly deposited  
 209 or generated in most real life situations” (lines 303 to 304), asking if radioactivity is not  
 210 randomly deposited. S. Hay and C. Gogolak discuss the concept of spatially-independent  
 211 versus spatially-correlated data. S. Doremus and C. Gogolak state that each measurement  
 212 corresponds to its nearest neighbor prior to and after the measurement, so that residual  
 213 radioactivity from nearby areas of elevated activity will be visible during scanning  
 214 surveys (as described in lines 302 to 303). This relationship constitutes spatially-  
 215 correlated data, answering S. Doremus’ objection. C. Gogolak adds that therefore the  
 216 standard definition of the mean does not apply for spatially-correlated data.

217 C. Gogolak disputes the statement from lines 311 to 312, stating that the use of detector  
 218 arrays surrounding the M&E with CSM systems will not be able to see 100% of residual  
 219 radioactivity, even with well-engineered detector arrays in a staggered configuration. He  
 220 reminds the WG that this issue will arise again in Chapter 5. S. Hay then poses the  
 221 question that if you can’t measure 100% using a CSM system, can you not use a CSM  
 222 system for Class 1 M&E? The use of CSM systems for Class 1 M&E will depend upon  
 223 the particulars of the system and the M&E being surveyed. C. Gogolak notes that  
 224 detectability and quantifiability are very important, and will be the source of extensive  
 225 comments on Chapter 5.

226 **ACTION ITEM:** S. Hay to locate a “flowchart expert” to assist with corrections  
 227 pertaining to specific box types to apply to figures 4.3 through 4.5.

228 C. Gogolak notes that the references to the LBGR in figures 4.3 through 4.5 (i.e., the  
 229 flowcharts) should be modified to read LBGR/UBGR.

230 R. Meck, C. Gogolak, N. Azzam, and S. Hay discuss the equation from lines 319 to 320:

231 
$$\% \text{ Scan} = \frac{\text{LBGR}}{\text{UBGR}} \times 100\%$$

232 C. Gogolak notes that the use of this equation ties back into an earlier comment he made  
233 regarding “major heartburn” over setting the Scenario B action level to the instrument  
234 MDC. He continues that this scenario works for Scenarios A and B if you tie the  
235 discrimination limit into the MDC. S. Hay questions the LBGR of zero in Scenario B.  
236 C. Gogolak ponders, and agrees that this does constitute a problem. C. Petullo moves  
237 that the issue be tabled and revisited by the end of the week.

238 **PARKING LOT:** Set the LBGR equal to zero when using Scenario B.

239 Note that this issue was resolved in the paragraph from lines 802 to 810 of this document,  
240 and has not been included in the list of parking lot items (at the end of this document).

241 G. Powers suggests stating that spatial variability is the heart of the survey design. S.  
242 Hay replies that this has already been described numerous places in numerous chapters.

243 S. Hay observes that MARSAME avoids talking about survey units since we don’t know  
244 how to define them. R. Meck responds that survey units are described and utilized in  
245 MARSAME, but it is different from MARSSIM because one size does not fit all, i.e.,  
246 survey unit sizes and shapes are completely dependent upon the nature of the M&E. S.  
247 Hay agrees, adding that survey units are not important in the survey design procedure.  
248 Survey unit specifics are superfluous if the radioactivity is measurable.

249 S. Hay furnishes an example of using MARSSIM guidance to determine that you have 13  
250 survey units, and yet you cover 100% of the 13 survey units in six measurements. How  
251 do you go about interpreting this data statistically? C. Gogolak comments that dose  
252 modeling action levels are not affected by areas of elevated activity and are only  
253 concerned with average activities. He continues that when using MARSAME, area  
254 factors may be one, infinity, or some fixed factor. The number of measurements may  
255 need to be adjusted if there is a mechanism for calculating a  $\text{DCGL}_{\text{EMC}}$ , but adjusting the  
256 systematic grid pertaining to your survey units does not affect the survey results.

## 257 IN TOTO MEASUREMENTS AND 100% SCAN DISCUSSION

258 C. Gogolak questions the definition of an in toto survey as a 100% scan. Is it therefore  
259 definitive of Class 1 M&E? S. Doremus notes that this means measuring an entire survey  
260 unit at one time. G. Powers, S. Hay, and C. Gogolak continue discussing the role of in  
261 toto surveys. G. Powers notes that you can’t see 100% using in toto surveys; S. Hay and  
262 S. Doremus respond that these are instrument limitations. R. Meck provides the example  
263 of using in situ gamma spectroscopy (ISGS) to perform an in toto count for 50% of an  
264 object – should this be called something besides in toto? S. Hay says no, this is still in  
265 toto with our current definition. S. Doremus suggests that the WG specify that in toto is  
266 Class 1. C. Gogolak notes that perhaps combining six ISGS counts (i.e., from six

267 different orientations) comprises one in toto measurement, and then notes that the WG  
 268 may be stuck with a definition of in toto that makes the term cumbersome. G. Powers  
 269 and R. Meck remark that per NUREG-1761, in toto means literally to measure the entire  
 270 survey unit. C. Gogolak suggests that maybe the WG can agree to having in toto  
 271 measurements, but not in toto surveys. C. Gogolak at flip-chart:

$$272 \quad \% \text{ Scan} = \text{Maximum} \left[ \left( \frac{10 - \frac{\Delta}{\sigma}}{10} \right) \times 100, \quad 10 \right]$$

273 S. Hay asks the WG if they are comfortable with stating that in toto means a 100% scan?  
 274 R. Meck responds that scan implies movement. C. Gogolak asks the WG if a scan means  
 275 movement or that a large area is being covered? The WG agrees that a scan means  
 276 movement. C. Petullo announces that for the purposes of this manual, an in toto  
 277 measurement may be used as a 100% scan, i.e., sampling 100% of the population. The  
 278 WG agrees to this. C. Petullo then questions the point of scanning 100% for Class 2 and  
 279 Class 3 M&E. The measurement of a pump by 100% scan with a GM is essentially  
 280 equivalent to an in toto measurement in a box counter. The WG agrees to this as well. C.  
 281 Gogolak then provides an example of using a GM to survey a piece of M&E smaller than  
 282 the active area of the detector probe. Would this be considered an in toto survey? The  
 283 WG indicates “yes.” S. Hay will rewrite Section 4.4 to reflect the change in  
 284 MARSAME’s definition for in toto, i.e., as a type of measurement that can be used for  
 285 scan-only surveys.

286 The WG revisits an action item for C. Gogolak from the February meeting minutes:

287 “Examine language in Section 4.4.3, line 341, and determine if 30% of the mean or 1/6 of  
 288 the DCGL is appropriate for the calculating the standard deviation. Currently, the text  
 289 states 30% of the mean, which is potentially a mistake dating back to MARSSIM  
 290 guidance.”

291 C. Gogolak states that this is **not** a mistake, and explains at flip-chart:

$$292 \quad \text{Coefficient of Variation} = \frac{\frac{\sigma}{\mu}}{\text{DCGL}} = \frac{5}{x} \sim 30\%$$

293 C. Gogolak states that the paragraph from lines 443 to 446 needs to address spatial  
 294 variation while discussing particulars of establishing a systematic grid.

295 S. Doremus questions the references to EPA QA/G-6 in the paragraph from lines 565 to  
 296 576, and asks if the WG is endorsing this document. S. Hay and N. Berliner indicate they  
 297 have both used the document and would endorse it having done so. The WG agrees.

298 S. Hay notes that there needs to be a process for developing SOPs in place within  
299 MARSAME. The discussion was added to the **PARKING LOT** for later discussion.  
300 The WG will begin Chapter 5 discussion tomorrow.  
301 ADJOURN

Meeting Date: June 14, 2005  
Date Prepared: August 24, 2005

**MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION  
MANUAL (MARSSIM) WORKGROUP MEETING NOTES**

TUESDAY, JUNE 14, 2005

ATTENDEES:

U.S. Environmental Protection Agency - USPHS: Captain C. Petullo  
U.S. Environmental Protection Agency - Region II: N. Azzam  
U.S. Nuclear Regulatory Commission - RES: R. Meck  
U.S. Nuclear Regulatory Commission - RES: G. Powers  
U.S. Air Force: R. Bhat (by phone)  
U.S. Air Force: Major C. Bias  
U.S. Navy: S. Doremus  
U.S. Army: D. Chambers  
U.S. Department of Homeland Security: C. Gogolak

MEMBERS OF THE PUBLIC:

Cabrera Services, Inc.: S. Hay (U.S. Air Force contractor)  
Cabrera Services, Inc.: N. Berliner (U.S. Air Force contractor)

CHAPTER 5

Discussion begins with Chapter 5. R. Meck opens general comments by stating that the instrument-specific sections are too detailed and should go back to an appendix, but keep Tables 5-1 and 5-2 in the chapter. The audience for the chapter should be assumed to be familiar with MARSSIM. The WG agrees.

**ACTION ITEM:** N. Berliner to ensure that line numbers track for excerpt files from larger documents submitted to the WG.

C. Gogolak states that he has fairly extensive general comments. He notes that he is leery of using NUREG-1507 for scanning uncertainty in Section 5.7, as the process is relatively dated now and should be updated. He also believes that the content for the detectability and quantifiability sections still need work. He suggests discussing uncertainty in a new section that will be linked to measurability:  
Uncertainty  $\Leftrightarrow$  MDC  $\Leftrightarrow$  MQC. The new discussion will start with uncertainty in general terms to allow applicability to any instrument, so that the instrument signal is converted to data through use of a model equation. C. Gogolak at flip-chart:

$$\text{Concentration} = F(x, x_1, x_2, \dots x_n) = F_n = \frac{\text{cpm}}{\text{efficiency}}$$

Where:

$F$  = concentration  
 $F_n$  = observed concentration  
 $x$  = signal (e.g., counts)  
 $x_n$  = other variables (count time, efficiency, volume, etc.)

337 C. Gogolak explains that efficiency is the key to total uncertainty. By the same token,  
 338 uncertainty is substantially more complicated than simply performing counts on a  
 339 standard. Efficiency is generally source geometry plus detector efficiency. The new  
 340 sections of Chapter 5 will discuss all of this and provide quantitative calculations to apply  
 341 the concepts to real-world conditions.

342 C. Gogolak continues that there will be a discussion of measurement uncertainty  
 343 propagated for all factors and the MDC, followed by an MQC discussion out of  
 344 MARLAP. S. Hay notes that this is 100 pages. C. Gogolak responds that this discussion  
 345 will either be distilled or referenced. The ISO document "*Guide to Expressing*  
 346 *Uncertainty*" (ISO GUM) will be used for propagated uncertainty calculations; NIST  
 347 Technical Note 1297 can be used as it distills the guidance in ISO GUM. He also adds  
 348 that the detectability (i.e., MDC) discussion must be expanded to include the critical level  
 349 (the signal that is detected 95% of the time), as well as  $\alpha$ ,  $\beta$ , etc. MARLAP method  
 350 uncertainty should be applied here, as it was developed for use with both field and  
 351 laboratory instruments. C. Gogolak continues that the MQC is effectively the average of  
 352 the MDC:

353  $\frac{\Delta}{3} \sim \sigma$  Satisfies the MDC  $\frac{\Delta}{10} \sim \sigma$  Satisfies the MQC

354 The above statements reflect the fact that the MDC is not concerned with the quantity,  
 355 only with whether there is residual radioactivity present or not. The MQC signifies  
 356 substantially more. The range of uncertainty can generally be estimated to be  $6\sigma$  (i.e.,  
 357  $\pm 3\sigma$ ). C. Gogolak states that we are placing a lot of weight in the detector efficiency and  
 358 MARSAME users calculating this parameter accurately, though it is necessary as it is  
 359 pivotal for uncertainty calculations. C. Gogolak also advocates for MARSAME to urge  
 360 users to estimate the uncertainty if  $\sigma$  cannot be quantified. It is much better to make a  
 361 "best estimate" than to simply ignore it. He adds that this process is more crucial for  
 362 MARSAME than it is for MARSSIM.

363 The WG would like to see this subject matter contained in many documents (e.g.,  
 364 MARLAP) and written well enough to allow an audience without a background in  
 365 statistics to follow and understand the discussion. R. Meck adds that these discussions  
 366 would make MARSAME truly substantive and useful; however, it will also be difficult to  
 367 get it written in a period of approximately three months. R. Meck then asks how to  
 368 approach this all in terms of source geometry? C. Gogolak responds that MARSAME  
 369 will provide a framework, which can be applied to both the instrument and source  
 370 material. R. Meck cautions that this might be perceived as too esoteric to be usable. The

371 information must be presented in a user friendly format that includes many representative  
372 situations:

- 373 • Geometries – plume/plane, sphere, cube, cylinder, point source
- 374 • Location – all on the near side, all on the far side, uniformly distributed on all  
375 surfaces, homogenous volumetric distribution, point source at center
- 376 • Model – hand calculations, rules of thumb, Microshield, MCNP<sup>1</sup>, ISOCS
- 377 • Material – metal, water, trash, container and waste

378 C. Gogolak suggests that the simplest approach is to model a cube using a germanium  
379 detector, and then count the cube at a single energy in several geometric configurations.  
380 C. Gogolak offers to perform some sample calculations with a Geiger counter and  
381 Microshield's method for absorbed dose. R. Meck notes that there should also be  
382 guidance for technicians at places like Eberline and Ludlum who perform instrument  
383 efficiency calculations. C. Petullo instructs that approximately six model situations for  
384 calculating uncertainty, detectability, and quantifiability will be very useful in the  
385 guidance in this chapter. These sections should also incorporate discussions related to  
386 controlling uncertainty for each potential source of uncertainty. C. Gogolak notes that  
387 these discussions are already there in words, but there needs to be quantitative analysis to  
388 accompany the discussions. One or two situations be put together initially and more will  
389 be added as time permits. This will tie back into revised sections in Chapter 2  
390 introducing to the idea of source geometry controlling uncertainty, and segregation  
391 helping to control uncertainty in source geometry. C. Bias adds that when Chapter 2 is  
392 revised, the reader should be referred to the appropriate sections in Chapter 5 related to  
393 the segregation discussion, and made aware that in Chapter 5 they will be required to  
394 model their source geometry. This discussion will also describe a range of problems  
395 related to improper or inadequate segregation, particularly spatial variation. N. Azzam  
396 asks if there should be a limit on the size of the uncertainty. S. Hay suggests that  
397 providing examples of how problematic poor segregation can be, noting perhaps five  
398 orders of magnitude are possible for heterogeneous scrap, resulting in huge uncertainties.  
399 N. Azzam adds that methods for reducing a controlled uncertainty should also be  
400 included.

401 S. Hay describes attempting to survey an alpha-contaminated scabbled concrete floor  
402 which will result in such large MDCs that even direct measurements will not be able to  
403 see any residual radioactivity. R. Meck notes that for box counting systems, source  
404 geometry is very important. C. Gogolak replies that this discussion is already in Chapter

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<sup>1</sup> MCNP (Monte Carlo N-Particle) is a Monte Carlo computer model that calculates the probability of interaction within a medium (i.e., the number of particles emitted from a source compared to the actual number of particles intercepted by a receptor medium is calculated). The particles are then "followed" and "scored" as they undergo interactions within the medium. The model must include a large number of events (on the order of 10 million) to comprise a substantial statistical basis, and the accuracy will also depend on the detailed specification of the source geometry and the receptor medium (lumen, catheter, tissue). MCNP is a Monte Carlo code originally developed at Los Alamos National Laboratory for neutrons, and has since been extended to include gamma rays and electrons as well. National Institute of Standards and Technology, 1998. "Glossary of Radiation Physics for Radiation Therapy." <http://physics.nist.gov/Divisions/Div846/Glossary/glossary.html> (July 2001).

405 5, though it still needs to be quantified. R. Meck agrees, and suggests that alpha and beta  
406 contamination be jettisoned in the situations we provide in Chapter 5 in favor of using  
407 gamma-emitting radionuclides like  $^{60}\text{Co}$  and  $^{137}\text{Cs}$ . S. Hay notes that instrument  
408 calibration in NUREG-1507 uses an assumed model of a stainless steel disc, and the use  
409 of something as simple should be a goal in MARSAME. The revised Chapter 5 will try  
410 and develop an example that is simple like the example from NUREG-1507 to clarify  
411 what will be done and who will do it.

412 C. Gogolak and R. Meck state that our objective here is to “open the door” for  
413 MARSAME users by providing operational level guidance showing users how to  
414 calculate a realistic MDC. Examples with uncertainty ranges related to a given set of  
415 parameters will prove to be very usable guidance. C. Gogolak adds that ISOCS systems  
416 will provide a good example of a commercially-available detector with software for  
417 modeling parameters related (integrated mini MCNP) to  
418 uncertainty/detectability/quantifiability.

419 The WG discusses the revised table of contents for Chapter 5. S. Hay notes that Health  
420 & Safety, Handling, and Segregation are all linked, and will possibly be combined into a  
421 single section. Sections 5.6 to 5.12 (“General Detection Instrumentation” through  
422 “Sample with Laboratory Analysis”) will all be moved to an appendix. Three new  
423 sections will be added to Chapter 5: Uncertainty, Detectability, and Quantifiability.

424 The WG specifies significant changes for Sections 5.13 and 5.14 (“Convert Data” and  
425 “Implement Quality Control”). As a general comment, both sections need to be re-  
426 written in the style of MARSSIM and MARSAME. The instructions need to be more  
427 generic, and they need to reference an ISO calibration standard (NUREG-1507). C. Bias  
428 and S. Hay suggest that Sections 5.13 and 5.14 be merged into a single section, as a  
429 QA/QC section, followed by another section pertaining to data collection. The WG  
430 approves of this format. The revised table of contents is listed below:

431 **5.1 Introduction**  
432 **5.2 Ensure Protection of Health and Safety**  
433 **5.3 Considerations for Handling M&E (Accessibility)**  
434 **5.4 Segregate the M&E<sup>2</sup>**  
435 **5.5 Select Instrumentation and Measurement Technique**  
436 **5.6 Uncertainty**  
437 **5.7 Detectability**  
438 **5.8 Quantifiability**  
439 **5.9 Quality Assurance**  
440 **5.9.1 Calibration/Response Checks/Ensure Instruments Work**  
441 **5.9.2 Quality Control During Measurements/Check Data Quality**  
442 **5.10 Collect the Data**

443 The WG returns to specific comments within Chapter 5. C. Petullo announces that the  
444 WG will review only material that will be retained in Chapter 5, Revision 8. Material  
445 that is to be placed into an appendix is not a priority at this juncture. NOTE: Many  
446 specific editorial comments noted at the meeting are not discussed in the minutes.

447 C. Gogolak and R. Meck notes that integrated industrial safety management must be  
448 incorporated into Section 5.2, as individuals must be concerned with total safety. R.  
449 Meck notes that the job safety analysis example may be below the level of the typical  
450 MARSAME reader. C. Bias comments that all of Section 5.2 may be considered for  
451 cutting. D. Chambers adds that a fourth basic means of controlling or correcting unsafe  
452 working conditions should be added to lines 52 through 58: signage. He also suggests  
453 consulting 29 CFR for additional examples.

454 **COMPARISON OF MARSSIM AND MARSAME TERMINOLOGY**

455 The WG discusses the differences between MARSSIM and MARSAME terminology. N.  
456 Azzam notes the following at the flip-chart:

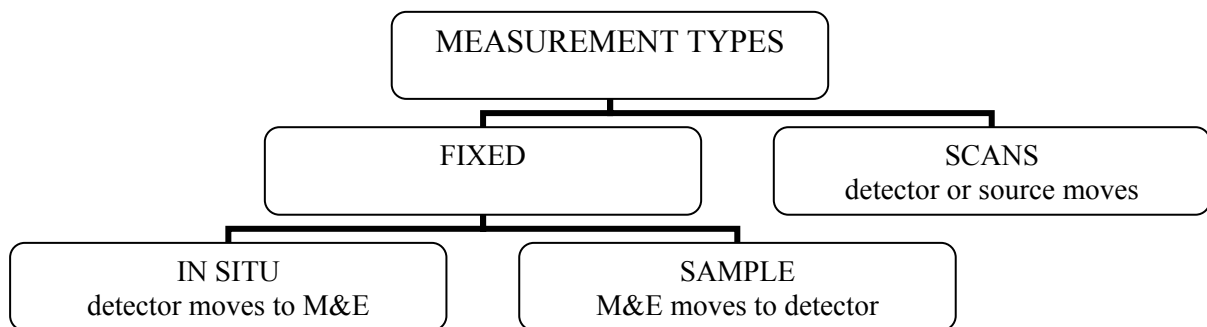
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<sup>2</sup> Please note that the alternate table of contents format as noted below:

**5.2 Segregate the M&E**

**5.2.1 Ensure Protection of Health and Safety**

**5.2.2 Considerations for Handling M&E (Accessibility)**



These terminology differences can be summarized as follows:

MARSSIM		MARSAME	
scan		scan (if source or detector moves)	
fixed measurement	direct measurement	fixed measurement	in situ measurement
	sample		sample

G. Powers states that the calibration section involves lots of electronic models and controls, such as MCNP. S. Hay notes that this section should cover discrepancies between the geometry of the calibration standard and the actual source of residual radioactivity in the field. These discrepancies should be linked to uncertainty.

S. Hay asks if Section 5.13 should consist of calibration, performance testing, and maintenance. C. Bias questions why maintenance should even be mentioned, as every organization has its own maintenance protocols, and MARSSIM did not broach this subject so MARSAME doesn't need to. G. Powers notes that maintenance was cut from NUREG-1761 as the guidance would not be useful without being extremely detailed. The WG agrees that generic quality control is the way to go for this section. S. Hay observes that the section needs to include calibration (guidance, consensus documents) and performance checks (background, operational, battery, inspection, spikes, duplicates).

The WG discusses the new data collection section. S. Hay notes that this section will cover checking the quality of data during collection to ensure the DQOs are met. N. Berliner at flip-chart:

- Record raw data honestly
- Mark numbers
- Include background
- Collect data consistently with survey design
- Document field changes

- 480     • Document deviations from survey design
- 481     • Document relevant legal information
- 482     • Do not massage data
- 483     • Back up electronic data
- 484     • Implement sample I.D. systems
- 485     • Use photographs (with scale)
- 486     • Record conditions regarding M&E that affect efficiency
- 487     • Reference M&E variability
- 488     The WG will begin Chapter 6 discussion tomorrow.
- 489     ADJOURN

490  
491

Meeting Date: June 15, 2005  
Date Prepared: August 24, 2005

492           **MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION**  
493           **MANUAL (MARSSIM) WORKGROUP MEETING NOTES**

494   WEDNESDAY, JUNE 15, 2005

495   ATTENDEES:

496   U.S. Environmental Protection Agency - USPHS: Captain C. Petullo  
497   U.S. Environmental Protection Agency - Headquarters: K. Snead  
498   U.S. Environmental Protection Agency - Region II: N. Azzam  
499   U.S. Nuclear Regulatory Commission - RES: R. Meck  
500   U.S. Nuclear Regulatory Commission - RES: G. Powers  
501   U.S. Air Force: R. Bhat  
502   U.S. Air Force: Major C. Bias  
503   U.S. Navy: S. Doremus  
504   U.S. Army: D. Chambers  
505   U.S. Department of Homeland Security: C. Gogolak

506   MEMBERS OF THE PUBLIC:

507   Cabrera Services, Inc.: S. Hay (U.S. Air Force contractor)  
508   Cabrera Services, Inc.: N. Berliner (U.S. Air Force contractor)

509   INTER-AGENCY STEERING COMMITTEE ON RADIATION STANDARDS  
510   (ISCORS)

511   K. Snead debriefs the WG regarding the 30-minute presentation she made to the ISCORS  
512   committee. She notes that A. Wallo questioned the percent scan for release, noting that  
513   100% might be too much for Class 1. A. Wallo was also concerned that there were solely  
514   options for scan-only and in toto surveys; A. Williams (who was also present at the  
515   meeting) responded that an option for a MARSSIM-type survey was available. A. Wallo  
516   also raised concerns that a single piece of equipment might have multiple classifications  
517   (e.g., a backhoe that doesn't need to be taken apart before it gets surveyed), and that the  
518   guidance would be too complicated to implement. A. Williams responded to several of  
519   these concerns. The next ISCORS meeting will be the public summer meeting, which  
520   will be held in an NRC auditorium. R. Meck will give the presentation.

521   CHAPTER 6

522   Discussion begins on Chapter 6. K. Snead opens with a general comment that the writing  
523   is a little choppy, as she can identify sections where scanning and in toto sections were  
524   inserted into the MARSSIM statistical framework.

525   S. Hay describes moving data conversion to Chapter 6, starting with counts and  
526   converting to the appropriate units. R. Meck states that he is unsure about moving this

527 material to Chapter 6; C. Gogolak suggests merely revisiting it in Chapter 6 while  
528 keeping it in Chapter 5. R. Meck also comments that moving sections like this one may  
529 be something that can wait in the interest of getting MARSAME out for public comment  
530 in September 2005. S. Doremus rebuts that pushing the document out too quickly and  
531 potentially not in as polished a condition as it could be will also undermine the WG's  
532 efforts. The WG agrees.

533 C. Bias notes that examples should be placed in the text of the data conversion section,  
534 which can initially be just descriptions and place-holders. Air Force or Cabrera HPs can  
535 then expand these examples with calculations. S. Hay agrees that the developed cube  
536 example can be placed in Chapter 5 with place holders for additional, more complicated  
537 examples to be expanded. N. Azzam suggests discussing the particular inputs and  
538 outputs for these examples. R. Meck mentions using a cube in a box counter. G. Powers  
539 adds that the use of Microshield or MCNP endorses the use of the respective product,  
540 thereby suggesting that models be run using both products and the numbers compared.  
541 R. Meck disagrees, citing that this approach is not as technically correct.

542 R. Meck, S. Hay, and N. Azzam discuss this issue further, and decide that Microshield,  
543 ISOCS, and hand calculations can be used to run parameters on soil impacted with <sup>137</sup>Cs  
544 and provide calculated ranges of numbers one would expect to see. S. Doremus asks if  
545 this should be the basis for a case study. S. Hay responds that some of this has already  
546 been done in some of the case studies, and R. Meck adds that this should be in the main  
547 body of the document. S. Hay comments that the case studies are set up with  
548 homogenous residual radioactivity, and that modeling examples with "worst case"  
549 contamination parameters will require additional development.

550 S. Doremus objects to the use of too many EPA reference documents, i.e., excessive  
551 references to EPA QA/G-9; K. Snead disagrees. C. Gogolak responds that these  
552 references pertain to our exclusive use of DQOs and DQAs; R. Meck adds that there are  
553 no equivalent NRC reference documents, so he has no problem using these references. S.  
554 Doremus concedes the point.

555 S. Doremus asks if calculating the mean average is a statistical test. C. Gogolak replies  
556 that it is a statistic; yet for the actual average you want an MQC, which must not exceed  
557 the action level. He continues that spatial variability figures into the MQC calculation,  
558 and this controls the Type I error. R. Meck notes that language should be inserted to  
559 describe the need for material sorting to address spatial variability; C. Gogolak responds  
560 that requiring an upper confidence level will mandate MARSAME users to compute  
561 uncertainty. He adds that every measurement in MARSSIM should be accompanied by  
562 an uncertainty and that MARSAME guidance will be more explicit in this capacity. The  
563 WG agrees.

564 C. Gogolak and S. Hay continue that confidence levels can be based on multiples of the  
565 total uncertainty (measurement uncertainty only). S. Hay notes that a section will need to  
566 be added to address confidence levels, and that the uncertainty must be calculated for the  
567 actual concentration (unlike the MQC which is calculated a priori at the action level). C.  
568 Gogolak also adds that for scan-only surveys the MDC must not exceed the action level.

569 If the MQC is adequately small, the total uncertainty is also small as there is no spatial  
570 variability associated with scanning surveys since 100% of the M&E is measured. The  
571 width of the grey region is in turn small enough that a 50% Type I error is relatively  
572 insignificant as the detection limits are “down in the noise.”

573 S. Doremus, C. Gogolak, and S. Hay then discuss the appropriate amount of data that is  
574 not excessive. G. Powers describes how collecting too much data is not a good approach  
575 to conducting surveys. He notes that when a licensee provides excess survey data, the  
576 NRC may instruct the licensee to select the correct number of data points and discard the  
577 remaining measurement data. S. Doremus then asks if a scan-only survey without  
578 recording data represents a statistical test. S. Hay responds that yes, it is a detection  
579 decision based on hypothesis testing.

580 S. Doremus questions the use of bullets as opposed to a numbered list starting on line 15.  
581 S. Hay responds that the MARSSIM convention is that numbers are applied if there are a  
582 specified number of steps; otherwise bullets are to be used.

583 C. Gogolak notes that some steps in Section 6.2 appear to be redundant if you’ve  
584 followed the DQO process, but the DQA process is independent. K. Snead asks if Table  
585 6.2 should be moved up earlier in the chapter. C. Gogolak responds that it corresponds  
586 with Step 4 in the DQO process<sup>3</sup>, so it is in the appropriate location.

587 K. Snead and C. Gogolak discuss scanning both with and without recording data. C.  
588 Gogolak notes that scanning in NUREG-1761 **requires** recording data, so additional  
589 differentiation is required in MARSAME Chapter 6 to highlight this difference. S. Hay  
590 notes that Chapter 6 needs to introduce survey types as follows:

591     • MARSSIM-type – Sign, WRS, EMC are statistical tests  
592     • Scan-only – MDC, MQC are statistical tests (i.e., reliably detect activity at specified  
593         values)

594 C. Gogolak describes the MDC as a statistical test, the MQC as a statistical number with  
595 an uncertainty, and the relative standard uncertainty as the measurement uncertainty  
596 related to the action level. K. Snead asks if another table should be added to Chapter 6  
597 corresponding to Tables 6.1, 6.2, and 6.3 and Sections 6.2.3, 6.2.4, and 6.2.5; the WG  
598 responds “yes.”

599 R. Meck notes that both Spanish MARSAME and NUREG-1761 stress material  
600 processing; K. Snead replies that material processing is not as much of an issue with  
601 MARSAME as most of the surveys this document will be used for are simply practical,  
602 operational surveys.

603 C. Gogolak notes that Chapter 6 needs three paragraphs to separately describe direct (i.e.,  
604 in situ) measurements versus scanning surveys versus MARSSIM-style surveys.

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<sup>3</sup> Step 2 – “look at data”

Step 3 – “look at test”

Step 4 – “compare data and test to see if they line up”

605 S. Hay asks if there is an EMC for Scenario B. C. Gogolak replies “yes,” but explains  
 606 that the WG is currently pushing for a NUREG-1505 convention opposing both EPA  
 607 QA/G-4 and MARLAP. G. Powers and C. Gogolak ask that the text clarify between  
 608 Scenarios A and B and to define what the action level represents in each case. C. Bias  
 609 requests that the reader be referred back to the first UBGR reference in Chapter 4 for  
 610 additional clarity.

611 R. Meck refers to the paragraph from lines 215 to 221, stating that the portions of the  
 612 M&E that are measured must be qualified when doing less than 100% scanning. S.  
 613 Doremus adds that when scanning less than 100%, inferences are made about the data  
 614 you don’t collect. C. Gogolak comments that implementation of less than 100% scanning  
 615 surveys requires inferences regarding the residual radioactivity and makes a case for  
 616 biasing towards the areas of highest potential activity. R. Meck adds (with reference to  
 617 line 221) that data indicating that these assumptions (pertaining to the portions of the  
 618 M&E surveyed) are not be reasonable should also prompt a review of the survey method.  
 619 S. Hay provides the example of finding plutonium in an area that is being investigated for  
 620 elevated levels of <sup>137</sup>Cs. S. Doremus requests that this be included as an example in the  
 621 text of Chapter 6.

622 C. Bias requests that the WG revisit Table 6.1. C. Gogolak suggests that the columns be  
 623 reversed. C. Petullo rewrites the table at flip-chart:

624 **Table 6.1 Selection of Statistical Tests Based on Survey Design**

Statistical Test or Evaluation Method	Survey Type
Compare to a Limit	Scan-Only without Data-Logging
Quantitative Evaluation (e.g., Confidence Level)	Scan-Only with Data-Logging Single Measurement Multiple Single Measurements
Non-Parametric Tests Combined with EMC (e.g., MARSSIM [Scenario A] and NUREG- 1505 [Scenario B])	MARSSIM-Type Survey

625 C. Gogolak and R. Meck state that use of the upper confidence level is a good approach.

626 **PARKING LOT:** Adjacent to how to calculate the standard deviation, how to calculate  
 627 the confidence interval and statistics on correlated data.

628 N. Azzam suggests using an approach used in risk assessment of looking at the highest  
 629 quantile. For example, take four measurements and use the largest of the four  
 630 measurements; for 10,000 measurements, use the 95<sup>th</sup> percentile. This approach takes  
 631 away the need for a confidence interval; however, it will not work for all situations (e.g.,  
 632 a single ISOCS measurement). C. Gogolak endorses this approach.

633 C. Gogolak refers to the paragraph from lines 266 to 273, stating that a quantile test is  
634 needed when conducting a MARSSIM-type survey for Scenario B applications (i.e., in  
635 addition to the sign and WRS tests). He explains that as soon as you measure something,  
636 you are above zero and the sign test becomes practically meaningless.

637 K. Snead notes that several different terms have been used to describe surveys based on  
638 MARSSIM: MARSSIM-style, MARSSIM-type, etc. The WG group decides that  
639 MARSSIM-type is the term that will be universally-applied in MARSAME.

640 C. Bias notes that Chapter 3 has a sizeable section pertaining to uncertainty (Section  
641 3.2.2), and that the WG should consider moving this section to Chapter 5. He also asks if  
642 all the guidance in Chapters 4 through 6 can be effectively applied to interdiction surveys  
643 (i.e., non-release surveys). Both of these items will be **considered by the contractor**  
644 **during development of revised chapters. Additionally, the topics have been added to the**  
645 **PARKING LOT to assist the WG in their review and initiate future discussions.**

646 R. Meck notes that Section 6.3.1 should be subdivided for Scenario B; R. Meck and C.  
647 Gogolak add that Scenario B should also be described and a Scenario B example  
648 provided in Section 6.4.2.

649 K. Snead notes that the concept of “clean as you go” is embedded in lines 546 to 547  
650 within Chapter 6. This key concept should be more pronounced within MARSAME as  
651 well as introduced earlier in the process. C. Bias suggests that the concept be  
652 incorporated into Chapter 5 within the segregation section. He also adds that the concept  
653 is really only applicable to Class 1 surveys.

654 The WG will discuss Case Study 3 tomorrow, then move to action items, parking lot  
655 issues, and other discussions that have been pushed off previously.

656 ADJOURN

657  
658

Meeting Date: June 16, 2005  
Date Prepared: August 24, 2005

659           **MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION**  
660           **MANUAL (MARSSIM) WORKGROUP MEETING NOTES**

661   THURSDAY, JUNE 16, 2005

662   ATTENDEES:

663   U.S. Environmental Protection Agency - USPHS: Captain C. Petullo  
664   U.S. Environmental Protection Agency - Headquarters: K. Snead  
665   U.S. Environmental Protection Agency - Region II: N. Azzam  
666   U.S. Nuclear Regulatory Commission - RES: R. Meck  
667   U.S. Nuclear Regulatory Commission - RES: G. Powers  
668   U.S. Air Force: R. Bhat (by phone)  
669   U.S. Air Force: Major C. Bias  
670   U.S. Navy: S. Doremus  
671   U.S. Army: D. Chambers  
672   U.S. Department of Homeland Security: C. Gogolak  
673   State of New Jersey - BER: N. Stanley  
674   State of New Jersey: J. Goodman

675   MEMBERS OF THE PUBLIC:

676   Cabrera Services, Inc.: S. Hay (U.S. Air Force contractor)  
677   Cabrera Services, Inc.: N. Berliner (U.S. Air Force contractor)

678   CASE STUDY 3

679   Discussion begins on Case Study 3. NOTE: Many specific editorial comments noted at  
680   the meeting are not discussed in the minutes.

681   At C. Petullo's request, N. Berliner describes the background for Case Study 3 for the  
682   benefit of the attendees from the State of New Jersey present. C. Petullo then asks if  
683   there are any large issues to consider with Case Study 3. N. Berliner replies that the use  
684   of Scenario B for interdiction to admit the rented equipment onto the site and the use of  
685   Scenario A to release it is causing some problems. C. Gogolak confirms that the current  
686   approach is correct, i.e., use of Regulatory Guide 1.86. R. Meck states that this is a case  
687   of "how hard do you look?" with the LBGR equal to zero. He adds that this will make a  
688   good example in MARSAME as people think that nothing detectable means zero. S. Hay  
689   comments that Regulatory Guide 1.86 represents the UBGR in both scenarios. S.  
690   Doremus suggests that the UBGR can be set at an administrative action level below the  
691   Regulatory Guide 1.86 criteria (at one-half of it). He adds that the purpose here is to  
692   provide guidance on how to set up scenarios A and B as opposed to establishing a  
693   realistic scenario. S. Hay responds that all measurements must be below the UBGR for  
694   Scenario B; the mean must be below the UBGR for Scenario A.

695 R. Meck comments that interdiction scanning for Class 1 equipment with no process  
696 knowledge is a good approach. K. Snead questions the use of Class 1 for the interdiction  
697 survey; C. Petullo agrees. S. Doremus indicates that the use of the same Class (i.e., level  
698 of survey effort) for the equipment coming in as going out is a good approach. S. Hay  
699 notes that the bucket, the tires, the cab, and the bottom of the loader are the most likely  
700 portions to contain areas of residual radioactivity and should be Class 1; other areas  
701 might be Class 2 or 3. S. Hay notes that a specific description of the operator entering  
702 and leaving the cab should be presented to illustrate why the floor, pedals, gear levers, and  
703 steering column are all Class 1. R. Meck notes that NUREG-1640 action levels may be  
704 applied for the cab.

705 S. Doremus comments that more is needed to set up the Class 1 interdiction survey  
706 design for the bucket and tires. D. Chambers adds that with multiple front loaders,  
707 process knowledge relates to where it is being used. The number of sites with radioactive  
708 materials in the area may be used as limited general process knowledge to make  
709 inferences regarding the likelihood of residual radioactivity on rented equipment.  
710 Additional process knowledge might consist of calling an entire loader used by a  
711 contractor on a site with radioactive materials Class 1, or classifying a brand new loader  
712 directly from the loader manufacturer non-impacted. Additionally, M&E cleared from  
713 one site may be accepted at another site without an interdiction survey if the supporting  
714 documentation is available. R. Meck objects, stating that it is **not** non-impacted. He  
715 explains that the true litmus test for Class 2 is knowing there is residual radioactivity, but  
716 not anticipating any measurements will exceed the action level.

717 C. Petullo and S. Hay question if process knowledge regarding where the rented  
718 equipment came from would be necessary to establish the radionuclides of potential  
719 concern (ROPCs). The use of Regulatory Guide 1.86 restrictive criteria for <sup>226</sup>Ra  
720 represents a conservative approach for the interdiction survey. S. Hay and S. Doremus  
721 note that the interdiction survey should be performed for the radionuclides present at the  
722 site where the equipment is to be used. R. Meck disagrees, citing that natural  
723 radionuclides should be used for the ROPCs in the interdiction survey. C. Bias notes that  
724 gross measurements should be used for interdiction. S. Doremus comments that <sup>60</sup>Co and  
725 <sup>137</sup>Cs are not typically seen at many types of facilities that utilize radioactive materials, so  
726 that surveying for a more common ROPC like <sup>226</sup>Ra is more restrictive and logical.

727 N. Azzam requests that a sentence or paragraph related to moving the loader from one  
728 area to another, i.e., decontamination without surveying between different areas. N.  
729 Berliner responds that the site model contains only one, large radiologically-controlled  
730 area that the loader does not exit from until all the site work is complete. This makes the  
731 concept of decontamination between different areas unnecessary.

732 C. Petullo asks C. Gogolak if the U.S. Coast Guard (DHS) should review this. C.  
733 Gogolak responds "yes." FRMAC (DOE) and FEMA should also review this case study.  
734 C. Gogolak then asks if the use of a portal monitor would be practical for this case study.  
735 S. Hay responds that the WG didn't want the example to be set up that way. N. Berliner  
736 also notes that the use of a portal monitor for a single front loader does not follow the

737 guidance in Chapter 5, which advocates for the use of portal monitors if there are  
738 multiple front loaders to be surveyed.

739 R. Meck notes that the case study should note in the introduction that the equipment  
740 comes in no worse than it goes out. G. Powers highlights that this is important as once  
741 you take control of it, you own it. R. Meck cites the DOE policy of “no rad. added,”  
742 meaning that the level of radioactivity in can also be the level of radioactivity out. He  
743 adds that the NRC is only concerned with exposure. N. Azzam then asks if a front loader  
744 with elevated areas of residual radioactivity may be permitted on-site and then released as  
745 such. The WG replies “no.”

746 C. Bias comments that an interdiction survey like this will be an SOP, asking if this case  
747 study is too burdensome without an SOP. S. Doremus, R. Meck, and C. Petullo state that  
748 it is not too burdensome. C. Bias suggests that this case study be split into two case  
749 studies, consisting of the interdiction survey and the release survey separately. He also  
750 notes that this case study should use the exact MARSAME table of contents. C. Petullo,  
751 K. Snead, R. Meck, and S. Doremus agree that the MARSAME table of contents must be  
752 preserved to keep the flow of the MARSAME process intact. The “case,” “objectives,”  
753 and “approach” from the DOE table of contents should be preserved. The WG also note  
754 that the case studies should be re-ordered as illustrated below:

<b>Case Study Description</b>	<b>Existing Case Study Number</b>	<b>Revised Case Study Number</b>
Release Crushed Concrete from Mineral Processing Facility	Case Study 1	Case Study 2
Release Tools and Equipment from Nuclear Powerplant	Case Study 2	Case Study 1
Interdict Front Loader into Mineral Processing Facility	Case Study 3	Case Study 3
Release Front Loader from Mineral Processing Facility		Case Study 4

755 C. Bias asks if the WG should advocate for dose- or risk-based guidance in MARSAME.  
756 R. Meck responds that MARSAME uses dose-based guidance in Case Study 1, so surface  
757 activity action levels are okay to use in this case study. The WG decides to use DOE  
758 Order 5400.5 familiar numbers and note that the numbers are derived from a relevant  
759 regulatory agency (there will be no mention of Regulatory Guide 1.86 or DOE Order  
760 5400.5).

761 The WG questions the extensive modeling used for establishing the volume of concrete  
762 dust that would adhere to the surfaces of the front loader. They vote to eliminate this  
763 from the case study since it detracts from the flow of the MARSAME process. They note  
764 that simply measuring some of the concrete dust on the surfaces of the loader to obtain a  
765 gross count is the preferred method for establishing the LBGR. C. Gogolak asks how to  
766 adjust for background in this scenario, noting that the loader represents its own reference

767 area. K. Snead comments that only some action levels require that you subtract out  
768 background.

769 **PARKING LOT:** How to do the background adjustment for the front loader.

770 S. Hay asks if a hand-held detector efficiency discussion pertaining to difficult-to-  
771 measure areas such as the corners of the loader bucket should be included in Chapter 5.  
772 The intent of this section would be to describe what can actually be measured. C. Petullo  
773 suggests that swipes might be used for these areas. K. Snead responds “no.” S. Hay  
774 indicates that static (i.e., in situ) measurements should be used (in lieu of scanning) to  
775 lower the MDCs for these areas.

776 C. Gogolak clarifies the approach that the front loader is to be power-washed, dried, and  
777 then a Class 1 Final Status survey should be performed. K. Snead, S. Hay, and N. Azzam  
778 all agree, stating that the power-wash helps to control the spread of contamination and  
779 improves the efficiency of the survey.

780 C. Petullo at flip-chart:

781 Scenarios A and B

- 782 • Detection Equipment
- 783 • Detection Calibration
- 784 • Detection Efficiency
- 785 • Action Level 100/300/20
- 786 • Disposition Option
- 787 • Background Material

788 C. Gogolak, N. Azzam, and S. Hay discuss problems using a GM detector to survey for  
789 <sup>226</sup>Ra and meet the Regulatory Guide 1.86 action level. K Snead suggests that alternate  
790 action levels can be selected, and D. Chambers adds that different instruments may also  
791 be employed. S. Hay replies that the contractor will locate an instrument that can be used  
792 to survey for <sup>226</sup>Ra and meet the Regulatory Guide 1.86 action level. MARSAME users  
793 will then have to look at this case study example and make the same determination for  
794 themselves. R. Meck endorses this approach in showing that use of this instrument with  
795 these ROPCs and associated action levels is good. It helps to illustrate that either you  
796 choose new action levels, a new instrument, or you put the manual on a shelf.

797 S. Hay presents the idea that interdiction doesn’t necessarily mean Scenario B. The  
798 disposition option is whether or not to allow the front loader on-site. Choose an action  
799 level to establish the LBGR – how hard do we have to look? The null hypothesis is no  
800 activity – we want to disprove the null hypothesis. If we reject the null hypothesis we  
801 disallow the front loader from entering the site.

802 S. Hay asks if a Scenario B example that uses an action level other than zero can be used.  
803 He notes that a sign test with the LBGR adjacent to zero does not look right. He states

804 that attempting to justify the use of Scenario B presents a problem. C. Gogolak, R.  
805 Meck, and C. Bias can not determine a Scenario B example in which the LBGR is set at  
806 something other than zero. R. Meck confirms that when using Scenario B, the LBGR  
807 must be restricted to zero. C. Gogolak notes that the less defensible the data the greater  
808 the likelihood that the null hypothesis will be rejected. R. Meck prompts the WG to  
809 revisit the percent scan when the LBGR equals zero. C. Gogolak notes that the ideal  
810 MARSSIM survey has  $\frac{\Delta}{\sigma} > 3$  and this will serve as a guide for scanning.

811 C. Gogolak requests that the scanning methodology described in NUREG-1507 be  
812 revisited, as it is over five years old now. G. Powers replies that it has been revisited,  
813 though not in sufficient detail. The WG determined that a peer review of MARSAME  
814 will provide critical review of the NUREG-1507 scanning methodology as well.

## 815 CHAPTER 5

816 Discussion moves to the sections in Chapter 5 that will be cut for Revision 8 and placed  
817 in an appendix. NOTE: Many specific editorial comments noted at the meeting are not  
818 discussed in the minutes.

819 S. Hay notes that general detection information will be compared or simply referenced to  
820 MARSSIM. C. Gogolak notes that MARSAME needs expanded uncertainty and related  
821 calculations to be considered a useful document when reviewed by ISO. R. Bhat notes  
822 that  $2\pi$  efficiencies should be used in Table 5-5, and that elaboration of the use of  $2\pi$   
823 versus  $4\pi$  source and detector efficiencies should be included. C. Gogolak notes that a  
824 figure to illustrate these differences should also be inserted.

825 When prompted by C. Petullo for input, J. Goodman comments that her office for the  
826 State of New Jersey uses MARSSIM frequently. She provided the WG feedback  
827 regarding confusion over the Scenario A versus Scenario B situation being discussed with  
828 this case study.

829 Action items, parking lot issues, and other discussions that have been pushed off  
830 previously will be addressed tomorrow.

831 ADJOURN

832  
833

Meeting Date: June 17, 2005  
Date Prepared: August 24, 2005

834           **MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION**  
835           **MANUAL (MARSSIM) WORKGROUP MEETING NOTES**

836   FRIDAY, JUNE 17, 2005

837   ATTENDEES:

838   U.S. Environmental Protection Agency - USPHS: Captain C. Petullo  
839   U.S. Environmental Protection Agency - Headquarters: K. Snead  
840   U.S. Environmental Protection Agency - Region II: N. Azzam  
841   U.S. Nuclear Regulatory Commission - RES: R. Meck  
842   U.S. Nuclear Regulatory Commission - RES: G. Powers  
843   U.S. Air Force: Major C. Bias  
844   U.S. Department of Homeland Security: C. Gogolak (by phone)

845   MEMBERS OF THE PUBLIC:

846   Cabrera Services, Inc.: S. Hay (U.S. Air Force contractor)  
847   Cabrera Services, Inc.: N. Berliner (U.S. Air Force contractor)

848   ACTION ITEMS

849   S. Hay at flip-chart:

- 850       • All – get MARSAME on SAB Review schedule
- 851           – review lines 222 to 230 in Chapter 4
- 852           – review lines 319 to 370 for Scenario B in Chapter 4
- 853           – ensure FRMAC, Coast Guard (DHS), FEMA, and U.S. Customs are all
- 854           included in MARSAME document review
- 855           – revisit “scale” (section 5.7.6 and others similar in Chapter 5)
- 856       • C. Gogolak – check with DHS regarding participation
- 857       • R. Meck – transmit revised Spanish MARSAME to the WG
- 858       • C. Petullo – copy and distribute IAEA document to the WG
- 859           – call A. Williams and ask him to talk to A. Wallo regarding seeking DHS
- 860           support for MARSAME through ISCORS
- 861       • C. Petullo/K. Snead – use of EPA site for IAEA document review
- 862       • R. Bhat – talk to Lt. Col. M. Wrobel about Air Force participation
- 863       • N. Berliner – talk to American Nuclear Insurers about “legal documentation”
- 864       • Cabrera – identify flowchart experts for correct flowchart boxes
- 865           – check discrimination limit versus level

866 S. Hay, R. Meck, and K. Snead discuss whether lines 222 to 230 in Chapter 4 should be  
867 deleted. MARSSIM was written under the assumption that there was never 100%  
868 remediation, which made the mandatory reclassifying of any survey unit Class 1 after  
869 remediation a prudent choice. R. Meck believes that remediation methods can be 100%  
870 effective in MARSAME allowing survey units to be Class 2 or 3 post-remediation. G.  
871 Powers adds that decontamination procedures will enable the least amount of survey  
872 effort and allow reclassification with process knowledge. C. Petullo has lingering  
873 hesitation about endorsing this approach. K. Snead, C. Petullo, and N. Azzam step out  
874 for an EPA caucus on this issue.

875 S. Hay notes that if part of the normal handling process for potential Class 1 M&E results  
876 in a reduction in activity which effectively reduces the potential for elevated  
877 concentrations of residual radioactivity, the M&E may be classified as Class 2.  
878 Documented process knowledge of these types of processes should be provided to justify  
879 this exception. He adds that this concept should be linked to segregation. C. Bias notes  
880 that segregation and remediation are very similar, related concepts, noting that M&E can  
881 be segregated, decontaminated, and then classified.

882 C. Petullo provides an example of a 200-foot by 200-foot pile of crushed concrete and  
883 scanning only 10% of the material, noting that she can not validate this approach. R.  
884 Meck responds that if you decontaminate the concrete with an effective decontamination  
885 method, you can survey the material as Class 2. C. Bias provides an example of a  
886 manufacturing facility that uses and subsequently decontaminates M&E. Logically the  
887 M&E is no longer expected to contain residual radioactivity in excess of applicable  
888 action levels. C. Petullo notes that this requires careful decontamination of 100% of the  
889 entire M&E population or else the survey will not find elevated areas of residual  
890 radioactivity. K. Snead concurs that 100% decontamination is imperative, stating  
891 objection to the use of automated methods for decontamination for reclassification. R.  
892 Meck responds that some circumstances will reasonably reduce the impacted material to  
893 below Class 1 levels. C. Bias qualifies that you decontaminate and reclassify with a  
894 “proceed at your own risk” caveat.

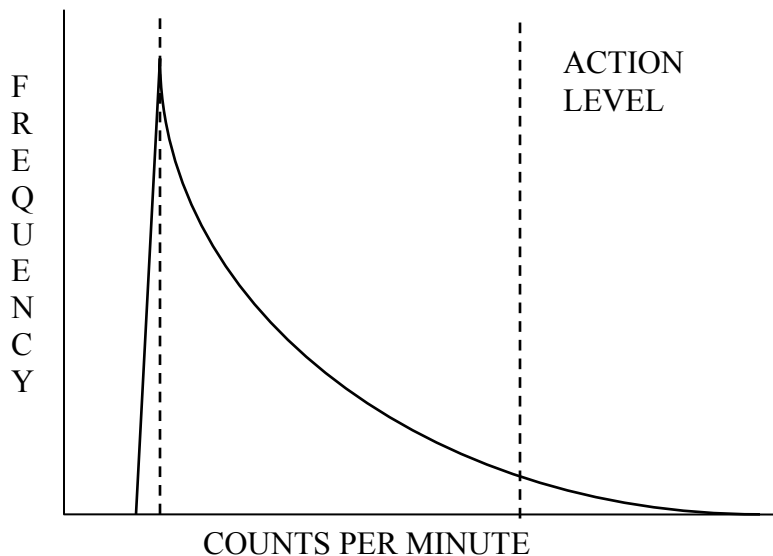
895 R. Meck instructs that language be inserted to be flexible but not prescriptive when it  
896 comes to reclassification. C. Petullo objects, stating that she can only agree to this if the  
897 guidance is prescriptive. She then reminds C. Bias and R. Meck that implementation in  
898 the field is seldom as effective in these capacities as the designing and planning phases  
899 might suggest. N. Azzam suggests the application of a confidence interval for  
900 decontamination effort. R. Meck responds that all decontamination efforts are supported  
901 by data and documentation. He continues that the MARSSIM and MARSAME processes  
902 provide a framework for reaching a technically-defensible end point, i.e., M&E with no  
903 reasonable probability of having residual radioactivity above the action level after  
904 decontamination. C. Petullo requests language stating that 100% decontamination prior  
905 to reclassification is mandatory. C. Bias argues that 100% decontamination is  
906 excessively prescriptive. R. Meck adds that the language states that decontamination and  
907 reclassification works effectively **sometimes**. C. Petullo disagrees, stating that this still  
908 constitutes excessively vague guidance.

909 **PARKING LOT:** Allow for reclassification of M&E as Class 2 or 3 post-remediation.

910 S. Hay/R. Meck at flip-chart:

	10%	50%	100%
$1 - \frac{\Delta}{3\sigma}$	$\frac{\Delta}{\sigma} = 2.7$	$\frac{\Delta}{\sigma} = 1.5$	$\frac{\Delta}{\sigma} = 0.3$
$1 - \frac{\Delta}{5\sigma}$	$\frac{\Delta}{\sigma} = 4.5$	$\frac{\Delta}{\sigma} = 2.5$	$\frac{\Delta}{\sigma} = 0.5$
$1 - \frac{\Delta}{10\sigma}$	$\frac{\Delta}{\sigma} = 9$	$\frac{\Delta}{\sigma} = 5$	$\frac{\Delta}{\sigma} = 1.0$

911 S. Hay notes that both  $1 - \frac{\Delta}{3\sigma}$  and  $1 - \frac{\Delta}{5\sigma}$  are feasible and either could work to determine  
 912 the scan percentage. S. Hay, R. Meck, N. Azzam, and C. Bias discuss. C. Bias asks if  
 913 you would expect the  $\sigma$  for M&E to be comparable to real property; R. Meck concurs. R.  
 914 Meck at flip-chart, stating that both  $1 - \frac{\Delta}{3\sigma}$  and  $1 - \frac{\Delta}{5\sigma}$  work below:



915  
 916 S. Hay notes that applying the same area factor of 1 to 3, and you will always have at  
 917 least 10% coverage. C. Gogolak notes  $145 - 45\frac{\Delta}{\sigma}$  and  $145 - 135\frac{\Delta}{\sigma}$  as percent scan  
 918 numbers. C. Petullo concludes action item and parking lot discussions – these topics  
 919 remain in the parking lot and discussions will be concluded at a later date.

920 SCHEDULE

921 C. Petullo announces that the July draft agenda calls for Chapters 1 and 6, and Case  
922 Studies 2 and 3. She notes that additional funding from the EPA and NRC will not be in  
923 place for another 30 days, due to a delay in the EPA's grants office. C. Bias adds that the  
924 Air Force needs the most recent invoice from Cabrera. S. Hay indicates that there was  
925 approximately \$25K left in the current budget at the end of May, that about \$3K to \$4K  
926 was spent finishing the deliverables for this meeting, and that \$5K was spent for S. Hay  
927 and N. Berliner to attend this meeting. He adds that he still can not have a 100%  
928 complete Chapter 1 by the next meeting, as more revisions will be needed after the July  
929 meeting. He also adds that C. Gogolak's input may be helpful for Chapter 1. C. Gogolak  
930 responds that Chapter 5 will need more work to finish than Chapter 6, and that he will  
931 help with both. He will be available to help for a couple of hours at a time, except for the  
932 week of July 9 to 15 (health physics meeting); he will tentatively plan on working with  
933 N. Berliner on the new sections of Chapter 5 from July 18 to 22.

934 R. Meck and C. Bias state that they would prefer to push off the July meeting as the new  
935 EPA funds will take approximately 30 days to be transferred from the EPA to the Air  
936 Force, and then another 30 days to be transferred from the Air Force to Cabrera. That  
937 funding will not be in place soon enough to support the next round of deliverables  
938 scheduled to be prepared for the July meeting. The WG decides to cancel the July  
939 meeting.

940 The WG schedules a conference call for July 26 at 1100 EST. This call will be designed  
941 to finalize the minutes from the June meeting, discuss funding status, review the status of  
942 Chapters 1, 5, and 6, and determine what can be prepared for the WG for the August  
943 meeting.

944 N. Azzam notes that D. Kopsick has okayed the use of the truck portal monitoring  
945 picture<sup>4</sup> in Chapter 5, as the line drawing looks funny. R. Meck and G. Powers state  
946 objections to using pictures, regardless of whether they are copyrighted, and regardless of  
947 whether the manufacturer names have been hidden or blurred.

948 C. Bias indicates that he will check on having source geometry calculations performed at  
949 AFIOH for Chapter 5.

950 ADJOURN

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<sup>4</sup> [http://www.canberra.com/pdf/Products/Systems\\_pdf/RadSentry.pdf](http://www.canberra.com/pdf/Products/Systems_pdf/RadSentry.pdf)

951

## ACTION ITEMS

- 952 All Get MARSAME scheduled for SAB review either for fall 2005 or spring  
953 2006.
- 954 Ensure FRMAC, Coast Guard (DHS), FEMA, and U.S. Customs are all  
955 included in MARSAME document review.
- 956 Revisit “scale” (section 5.7.6 and others similar in Chapter 5).
- 957 C. Gogolak Check as to whether another DHS representative would be assigned to the  
958 MARSSIM WG after his scheduled departure by January 1, 2006.
- 959 C. Petullo Call A. Williams and ask him to talk to A. Wallo regarding DHS support  
960 for MARSAME through ISCORS.
- 961 C. Petullo/K. Snead Furnish electronic copy of IAEA document to the WG. The  
962 document may be posted on a secure EPA site for review.
- 963 R. Meck Distribute electronic copy of Spanish MARSAME to the WG.
- 964 Find Health Physics Positions (HPPOS) NUREG document *Guide on*  
965 *“How Hard You Have to Look” as Part of Radioactive Contamination*  
966 *Control Program* (HPPOS-072 PDR-9111210170), and email to S. Hay.
- 967 R. Bhat Confirm the future of Air Force participation (i.e., C. Bias or another  
968 representative) in the MARSSIM WG with Lt. Col. M. Wrobel.
- 969 S. Hay Check for discrimination limit versus discrimination level. According to  
970 MARLAP, the correct term should be discrimination limit.
- 971 Locate a “flowchart expert” to assist with corrections pertaining to specific  
972 box types to apply to figures 4.3 through 4.5.
- 973 N. Berliner Ensure that line numbers track for excerpt files from larger documents  
974 submitted to the WG.
- 975 Talk to American Nuclear Insurers about “legal documentation.”

976

## PARKING LOT

977 Class 3 definition in MARSSIM may need adjustment to cover the “simple” case where  
978 the relative shift is very large, which may become the definition of Class 3.

979 Develop an FAQ on classification to decide when an area is Class 2 and not Class 1 or  
980 Class 3.

981 Given a classification of Class 2 or Class 3, provide a % scan to release. Determine  
982 whether scan coverage can be 0% in Class 3 areas.

983 Should MARSAME include prior knowledge (process knowledge) to design a disposition  
984 survey using a Bayesian approach?

985 Develop a range of expected values for radionuclide relationships that may be used for  
986 surrogate measurements.

987 Review the structure of Section 3.2.4.

988 Where are survey unit boundaries finalized, Chapter 3 or (new) Chapter 4?

989 Perform a pilot study to evaluate the MARSAME guidance. Suggested locations include  
990 Nellis AFB and Hunters Point Naval Shipyard. OSWER may perform pilot study for  
991 chemical contaminants.

992 ~~Include the concept of “clean-as-you-go” in MARSAME.~~

993 Develop an FAQ on reliability of individual scanning instruments and other equipment  
994 (e.g., global positioning system) used to collect data during radiological surveys.

995 Develop tables summarizing the important examples from the Case Studies.

996 A Chapter 2 revision comment by S. Doremus from the web site brings up the issue of  
997 ROPCs versus ROCs, i.e., the initial versus final list of radionuclides of concern.  
998 Chapter 2 states the list of radionuclides of concern may be expanded, reduced, or remain  
999 the same based on the results of preliminary surveys.

1000 Inclusion of a section for grappling hook detectors in Chapter 5 (i.e., corresponding  
1001 appendix).

1002 Inclusion of a section for smear sampling in Chapter 5.

1003 Adjacent to how to calculate the standard deviation, how to calculate the confidence  
1004 interval and statistics on correlated data.

1005 How to do the background adjustment for the front loader.

1006 Allow for reclassification of M&E as Class 2 or 3 post-remediation.

- 1007 Include a process for developing SOPs in place within MARSAME?
- 1008 Move Section 3.2.2 regarding uncertainty to Chapter 5?
- 1009 Can the guidance in Chapters 4 through 6 can be effectively applied to interdiction
- 1010 surveys (i.e., non-release surveys)?